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REMARKS

The allowability of claims 16-19 mentioned on page 9 of the Official Action is noted with appreciation. Claims 16-19 have been rewritten as new claims 32-34 with independent claim 32 incorporating all of the limitations of original base claim 14.

Claims 5 and 25 have been amended to obviate the rejection of such claims under 35 U.S.C. § 112, second paragraph. The amended range of claim 5 is inherently supported by the present specification at page 6, lines 14-17. *In re Wertheim*, 191 USPQ 90 (CCPA 1976).

Claims 1-7, 10-16, 21-23 and 26-29 are rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,278,231 to Iwasaki et al ("Iwasaki et al"). Patentees are indicated as teaching a method for forming a film of aluminum on a ceramic substrate, loading the film with catalytic metal, and growing carbon nanotubes by a chemical vapor deposition process using ethylene (page 3, first two paragraphs of the Office Action). However, it is submitted that Applicants' process is not anticipated by Iwasaki et al.

Applicants have discovered a process for forming a film of carbon nanotubes having a small outside diameter and uniformly aligned by utilizing a substrate that is coated with a metallic element having no catalytic ability by itself, which, in turn, is coated with a metallic element having catalytic ability. As indicated in the discussion from page 2, last line to page 3, line 14 of the present specification, prior methods, such as that in which "an aluminum substrate is anodized to prepare a template and cobalt is electrochemically deposited into the bottom of the channels in the oxide film" have a number of problems, including the generation of an aligned film of thick carbon nanotubes greater than 20 nm in outside diameter. This should be contrasted with Applicants' process which, as shown in Example 1, can produce smaller diameter nanotubes having outside diameters of 5-8 nm.

Similarly to such prior methods, Iwasaki et al anodize an aluminum film on the substrate prior to depositing cobalt. Thus, Iwasaki et al disclose a process for making carbon nanotubes, which first involves forming an aluminum film on a silicon substrate (see col. 15, lines 24, et seq.), but unlike Applicants' method, the Al film is then subjected to anodization with oxalic acid to form nanoholes. Iwasaki et al describe the anodization process in the paragraph bridging columns 7-8 and the use of oxalic or other acids in the anodization process (column 8, lines 17-24).

Claim 1 has been amended to recite a process in which the substrate is prepared by a process which "consists essentially of" coating the substrate with an element having no catalytic ability followed by coating the noncatalytic coating with a metallic element having catalytic ability. Such claim language excludes the anodization treatment of Iwasaki et al, since such treatment would materially affect the characteristics of Applicants' claimed process, which is to produce small diameter nanotubes. Likewise, the present specification has been amended on pages 5 and 6 consistent with the aforesaid discussion on page 3, lines 1-14 concerning such problems resulting from anodization.

Since claim 1 is not anticipated by Iwasaki et al, claims 2-7, 10-13, 23, 27 and 28, which are either directly or ultimately dependent from claim 1 are likewise not anticipated by Iwasaki et al. Also, independent claim 14 has been amended to recite that following the coating of the ceramic sheet with aluminum, the coated sheet is "next loaded" with the cobalt compound and then calcined to distinguish Iwasaki et al, who anodize the coated aluminum prior to loading a catalytic coating. Support for amended claim 14 is found throughout the specification. However, specifically in Example 1 (pages 11-12), the sequence of depositing an aluminum file and indicating the substrate is "then dipped" in an aqueous solution of cobalt nitrate, supports the language of amended claim 14. The term "then" as used in

Example 1 means "next" in order. Claims 15, 16, 21, 22, 26 and 29, which are directly or ultimately dependent from claim 14 are not anticipated by Iwasaki et al. Accordingly, the rejection of claims 1-7, 10-16, 21-23 and 26-29 as anticipated by Iwasaki et al should be withdrawn.

Claims 1-3, 6, 13, 23 and 27-28 are rejected as being anticipated by Dai et al (page 3, last two paragraphs of the Office Action).

Dai et al disclose (col. 3, lines 6, et seq.) use of a silicon substrate 22 and a porous top layer 24 also of silicon, with an iron oxide catalyst 26 for making carbon nanotubes. The porous layer 24 is produced by electrochemically etching the substrate 22 (col. 3, lines 49-57). The porous layer produced by electrochemical etching with HF with an anodization current in Dai et al is similar to the formation of nanoholes produced by the anodization of aluminum by Iwasaki et al with the same disadvantages. Accordingly, the comments previously made as to Iwasaki et al with respect to claim 1 are applicable to Dai et al, and need not be repeated. Likewise, claims 2, 3, 13, 23 and 27-28 dependent from claim 1 are likewise not anticipated by Dai et al.

Claims 1-4, 6-8, 10-14, 20-22, and 27-28 are rejected as being anticipated by the Li et al article ("Li et al").

Li et al disclose anodization of aluminum on a substrate using oxalic acid to form pores of the anodic alumina film followed by electrochemically depositing a cobalt catalyst into the channels (paragraph bridging pages 367-368). The catalyst is then reduced and then subjected to acetylene in nitrogen to form the nanotubes. The Li et al anodization process is similar to that of Iwasaki et al, discussed previously, who also require anodization. Thus, the comments made previously concerning Iwasaki et al are also applicable to Li et al and need not be repeated.

Claims 8, 9 and 20 are rejected as being either anticipated or obvious over Iwasaki et al on the ground that it is expected that the cobalt particle sizes would be within the claimed ranges, because they are deposited within the nanoscale diameter channels and the nanotubes are known to have diameters corresponding to the diameter of the catalyst particles from which they are grown, and thus ranging from 2 nm to 50 nm.

Initially, the rejection appears to be improper under Section 102(e), which requires either that the claimed range be explicitly disclosed or to be inherent. It is admittedly not explicitly disclosed, and in order to be inherent, the Examiner must demonstrate that those skilled in the art would expect the particles to be within the claimed range, which has not been done. No evidence has been cited and Applicants request that the Examiner provide a evidence in support of his position. Moreover, if such point is based on personal knowledge, the Examiner is requested to provide a personal declaration in support of such knowledge of those skilled in the art.

In addition, since claims 1 and 14 are distinguishable from Iwasaki et al, dependent claims 8, 9 and 20 are likewise distinguishable. Accordingly, the rejection of claims 8, 9 and 20 as anticipated or obvious over Iwasaki et al should be withdrawn.

Claims 8-9 are rejected as being either anticipated or obvious over Dai et al. It is believed that Applicants' comments concerning the rejection of claims 8, 9 and 20 over Iwasaki et al, above, are applicable to Dai et al as well, and will not be repeated so to not burden the record.

Claims 25 and 31 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Iwasaki et al (paragraph bridging pages 5-6 of the Office Action) on the ground that it would be obvious to heat the ceramic substrate to dry prior to applying the Al film to ensure a uniform film. However, as indicated on page 5, final paragraph of Applicants' specification,

such drying is performed for various reasons, not disclosed or rendered obvious by Iwasaki et al or any reference cited by the Examiner. The Examiner is requested to provide evidence of the obviousness of drying the substrate, or his personal declaration, if based on personal knowledge. Further, since claims 25 and 31 are dependent from claims 1 and 14, respectively, which are distinguishable from Iwasaki et al for the reasons previously set forth, the rejection of such claims should be withdrawn.

Claims 24 and 30 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Iwasaki et al in further view of Ohki et al on the ground that it would be obvious to use the silica-alumina substrate of Ohki et al in the process of Iwasaki et al. Ohki et al, who disclose (col. 4, line 59) a silica-alumina substrate, do not remedy the deficiencies of Iwasaki et al that are discussed above. Thus, even if Ohki et al and Iwasaki et al were combinable, the resulting process would not be that of claim 24 or claim 30, which claims are dependent from claims 1 and 14, respectively. Accordingly, the rejection of claims 24 and 30 should be withdrawn.

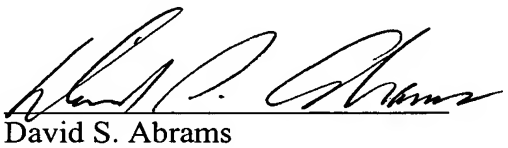
Claims 4-5, 7-9 and 11 are rejected as being obvious over Dai et al. As previously indicated, Dai et al form a top layer by electrochemical etching of the silicon layer, which is proscribed by amended claim 1. Since the rejected claims depend from claim 1, they are likewise patentable. Moreover, this rejection is apparently based on the personal knowledge of the Examiner, since no reference has been cited to supply the features of the rejected claims not disclosed by Dai et al. Accordingly, it is requested that the Examiner provide evidence in support of the obviousness of the claimed features of the rejected dependent claims not shown by Dai et al or provide his personal declaration. Accordingly, the rejection of claims 4-5, 7-9 and 11 should be withdrawn.

Claim 24 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Dai et al in view of Ohki et al on the ground that it would be obvious to substitute the silica-alumina substrate for that of Dai et al. As pointed out previously, claim 1 is patentably distinguishable from Dai et al. Since Ohki et al do not supply the deficiencies of Dai et al, claim 24, which is ultimately dependent from claim 1, is likewise patentable over Dai et al in view of Ohki et al. Accordingly, this rejection should be withdrawn.

Claims 5, 9 and 15 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Li et al in view of Moskovits et al. Moskovits et al is similar to Li et al in anodizing aluminum using an oxalic acid bath, and thus cannot remedy the deficiencies of Li et al. Accordingly, for the reasons previously presented, neither Li et al nor Moskovits et al distinguish independent claims 1 and 14, from which the rejected claims depend. Accordingly, since Moskovits et al cannot remedy the deficiencies of Li et al, the rejection of claims 5, 9 and 15 should be withdrawn.

For the foregoing reasons, the claims are now in condition for allowance and should be passed to issue. Such action is earnestly solicited.

Respectfully submitted,



David S. Abrams
Reg. No. 22,576

Roylance, Abrams, Berdo & Goodman, L.L.P.
1300 19th Street, N.W., Suite 600
Washington, D.C. 20036
(202) 659-9076

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